

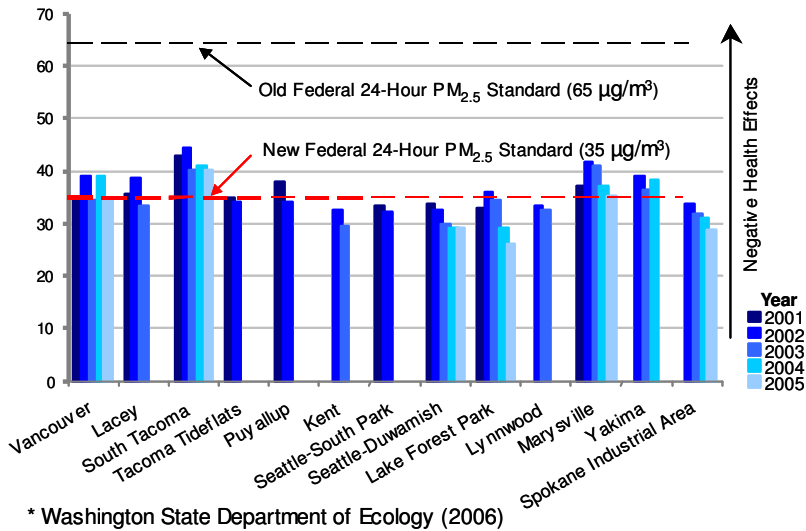
How Does Washington Measure Up?

The EPA establishes national air quality standards to protect public health. When air pollution persistently exceeds these standards, the area is designated as “nonattainment”. Diesel exhaust contributes to levels of PM_{2.5} and ground level ozone that exceed the national standards in many areas across the nation. The EPA has not set a standard specific to diesel exhaust.

Washington State is currently in attainment for both particulate matter and ozone. However, the EPA recently tightened one of its PM_{2.5} standards. As a result, it is likely that some areas in Washington will be designated as non-attainment within the next few years. More may follow when additional monitoring data is available.

By working today, we can help avoid violating these standards in the future and improve air quality.

Washington State 24-Hour Average Concentration of PM_{2.5}
98th Percentile Three Year Average (µg/m³) at Monitoring Sites



Diesel Emission and the Environment

Diesel exhaust contributes to several air pollutants that can be harmful for the environment. Ozone and fine particles from diesel engines can form atmospheric haze, blocking views and scenery. Ozone also damages the environment and can make plants and crops more susceptible to disease or damage.

The NO_x and sulfur in diesel emissions contribute to acid rain that damages streams, ponds, and lakes. In addition, greenhouses like CO₂ contribute to global warming.

Clear View of Mount Rainier



Hazy View Around Mount Rainier



* Puget Sound Clean Air Agency

**Reducing Diesel Emissions in Washington State:
Understanding Diesel Emissions**

Emissions from diesel engines can be harmful to public health and the environment. Here is information to help explain the problem.

We find diesel engines are nearly everywhere. They power the movement of goods that support our economy, help construct buildings and roads, carry children to school, and move transit vehicles. While these engines are critical to our economy and lifestyles, their unfiltered exhaust contains harmful pollutants.

Why are Diesel Emissions a Concern?

Diesel engines emit a complex mix of air pollutants, mainly made up of gases and solid particles that many people can see as dark soot. These include many carbon particles as well as toxic gases and metals.

The microscopic soot in diesel emissions is one source of fine particulate matter (PM_{2.5}), which is made up of very small particles and droplets in the air. These fine particles are so small that several thousand of them could fit on the period at the end of this sentence. They are a health concern because they can be breathed deeply into the lungs and sometimes pass directly into the bloodstream - potentially affecting the lungs, heart, and other organs.

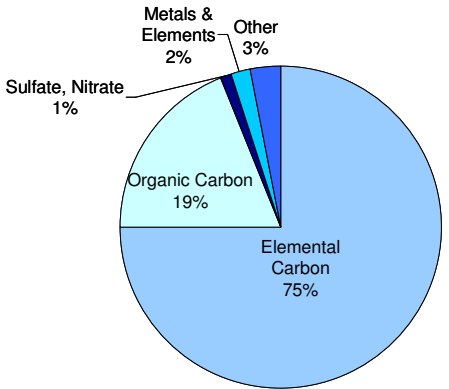
The US Environmental Protection Agency (EPA) has identified the mix of diesel particulate matter (DPM) as a toxic air contaminant causing harmful health effects, potentially including cancer. DPM has been identified as one of six priority toxic pollutants of national concern linked to transportation (known as mobile source air toxics or MSATs).

Diesel exhaust also contains nitrogen oxides (NO_x) and volatile organic compounds (VOCs or hydrocarbons). These pollutants contribute to ground-level ozone or smog. Breathing ozone can worsen asthma and other lung diseases. The combustion of diesel fuel also produces greenhouse gases, such as carbon dioxide (CO₂). However, health and environmental communities are primarily concerned about the toxic effects of diesel particulate matter.

Researchers Learn More About Diesel Each Year

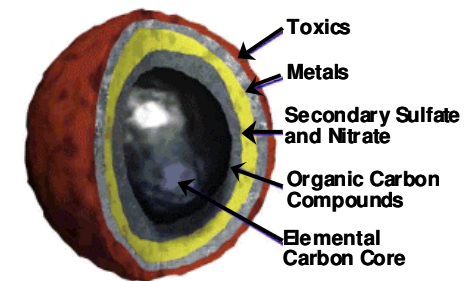
Emissions from diesel engines, especially particulate matter, appear to contribute to a number of health problems. Long-term exposure is associated with an increased risk of heart and lung diseases, including lung cancer and heart attacks, and may lead to premature death. Short-term exposure can irritate the eyes, nose, and throat, and cause difficulty breathing, fatigue, and headaches. Children, outdoor workers, people with heart and lung disease, and the elderly are most at risk.

Typical Chemical Composition of Fine Particulate Matter (PM_{2.5}) from Diesel Vehicle Exhaust



* Health Effects Institute (2003)

Diesel Particle After Released from an Engine



Diesel particles are carbon at their core with toxics and carcinogenic substances attached to their surfaces.

* Clean Air Task Force (2005)

Estimated Annual Health Impacts in Washington State From Diesel Soot (1999)

Premature Deaths	248
Lung Cancer Deaths	23
Non-fatal Heart Attacks	308
Asthma Attacks	6,201
Chronic Bronchitis	181
Lost Work Days	37,787
Minor Restricted Activity Days	218,999
* Clean Air Task Force (2005)	
Washington State Population (1999)	5,830,835

For More Information

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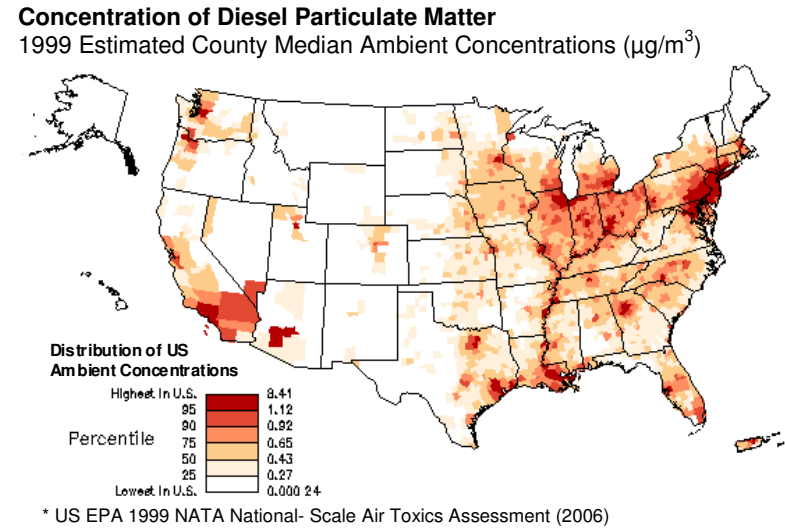
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Diesel Emissions are Often Concentrated in Urban Areas

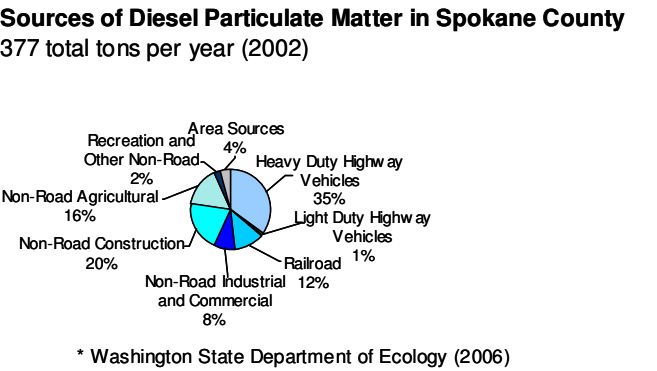
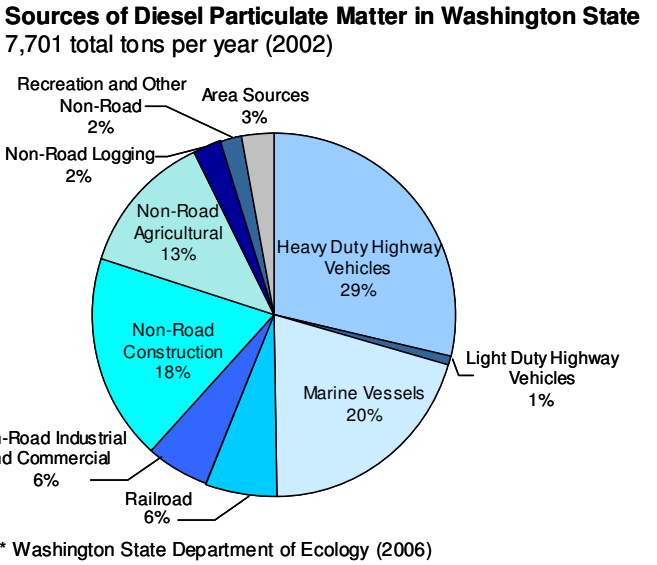
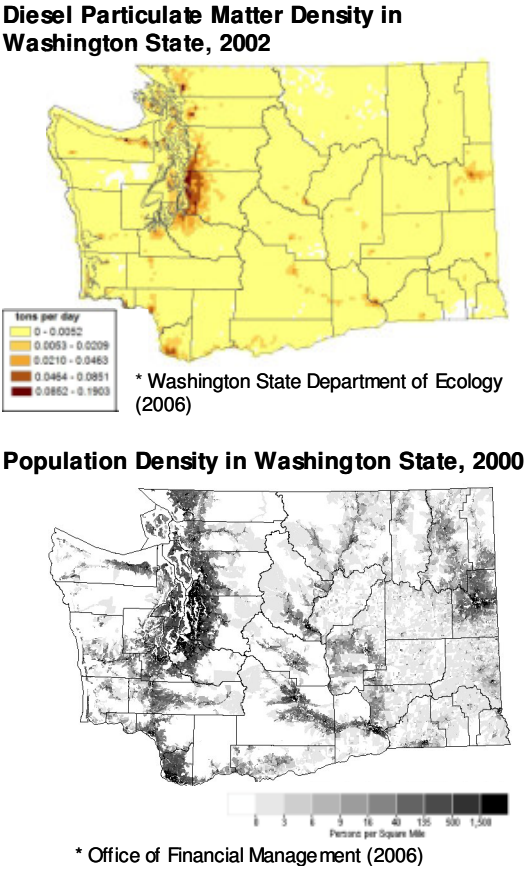
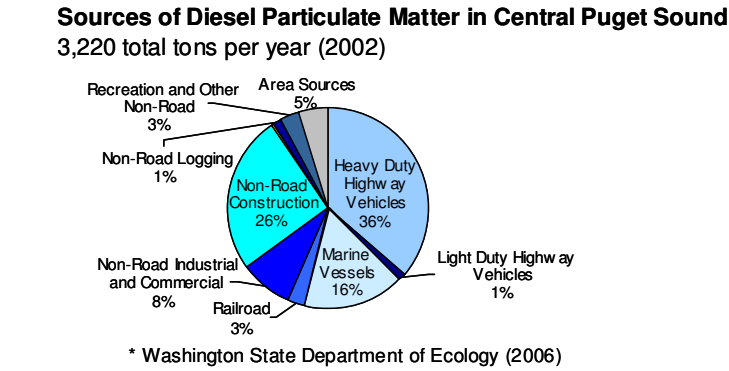
Diesel emissions affect both urban and rural communities, but they create the most problems for populations living and working very close to diesel sources. The following charts show how diesel emissions are often concentrated in urban areas, where high population density also means that more people are exposed. Each person can be exposed to a unique level of emissions based on how close they are to significant sources.



Where do Diesel Emissions in Washington State Come From?

Recent studies by the Washington State Department of Ecology show that most diesel emissions in the state come from roadway vehicles (such as trucks and buses), marine vessels, construction, and agricultural equipment.

With Washington's diverse regions, sources of diesel emissions can vary greatly across the state. In Spokane County, marine vessels are not a source of diesel emissions, but in Central Puget Sound marine vessels contributed 16 percent of diesel particulate matter in 2002. WSDOT is participating in a study with the Puget Sound Maritime Air Forum to refine information about marine emissions in Central Puget Sound.



Diesel Exhaust and Cancer

The Department of Health and Human Services, EPA, National Air Toxicology Association, National Institute of Environmental Health Sciences, and World Health Organization have all listed diesel exhaust as a likely or probable carcinogen. Long-term exposure may pose a risk for lung cancer, as well as other types of soft tissue cancer.

About 90 percent of lung cancer is caused by active smoking. Responsibility for the remaining 10 percent is split among second-hand smoke, previous exposure to asbestos, exposure to radon gas, and other causes, including diesel exhaust. Of the cancer risk from air borne pollutants, the Washington State Department of Ecology estimates that diesel particulates cause about 70 percent.

Different agencies have developed different methodologies and risk factors used to calculate the risk of cancer based on exposure.

The US EPA, in 2002, found diesel exhaust to be a likely human carcinogen, but did not adopt a risk factor. EPA did estimate a possible range of lung cancer risk from exposure to diesel exhaust in the environment ranging from 0.1 to 10 excess cancer risks in 10,000 people per 1 µg/m³ diesel PM lifetime exposure of 70 years. This range is based on exhaust emissions from diesel engines built before the mid 1990s.

The California Air Resource Board, in 1998, assigned a unit risk value of 3 excess cancer cases in 10,000 people per 1 µg/m³ diesel PM lifetime exposure.

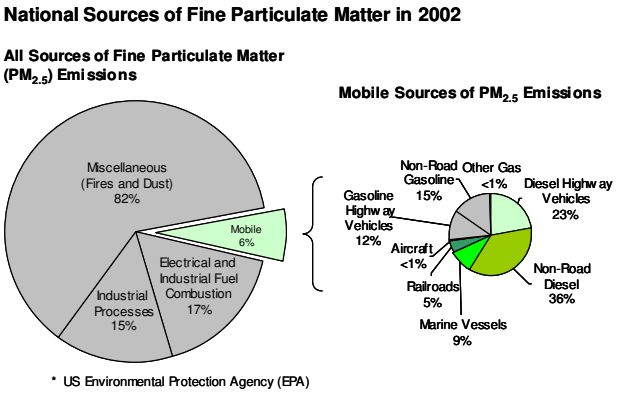
* Health Effects Institute (2003), American Cancer Society (2006), US Environmental Protection Agency (2002), California Air Resource Board (1998)

How Much Does Diesel Exhaust Contribute to Air Pollutants?

In addition to the specific toxicity concerns of diesel particulate matter, diesel exhaust contributes to levels of pollutants in the air. Diesel is one of many sources for these air pollutants. The following information provides a snapshot of sources for some of these pollutants, and how much diesel engines contribute to levels of these pollutants in the air. Sources vary from region to region, and pose the greatest concern for public health when they occur close to populations.

National Perspective - Diesel Emissions Contribute Five Percent of all PM_{2.5}

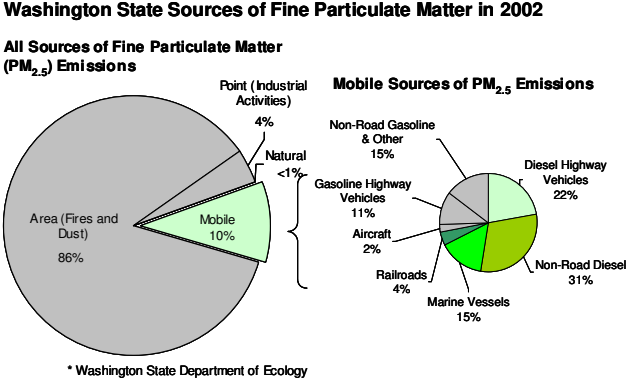
Data used today for the nation as a whole, indicates that diesel emissions contribute five percent of all fine particulate matter (PM_{2.5}). This is equal to 72 percent of PM_{2.5} from mobile sources, which are six percent of all sources.



Diesel emissions also contribute 33 percent of all nitrogen oxides (NO_x), three percent of all volatile organic compounds (VOC), three percent of all sulfur oxides (SO_x), and two percent of all carbon monoxide (CO) at the national level.

Washington State Perspective - Diesel Emissions Contribute Seven Percent of all PM_{2.5}

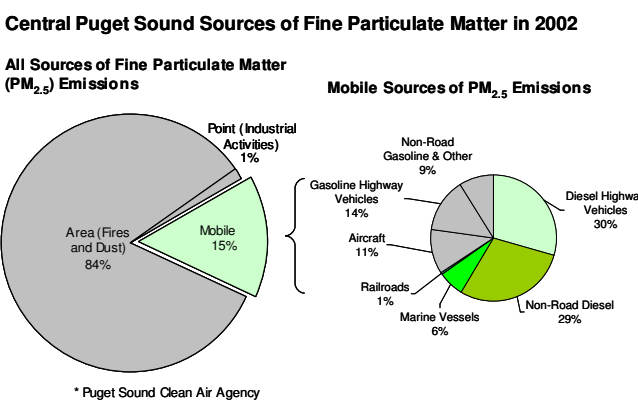
In Washington State, data indicates that diesel emissions contribute seven percent of all fine particulates. This is equal to 72 percent of mobile sources, which are 10 percent of all PM_{2.5} sources.



Diesel emissions also contribute 45 percent of all nitrogen oxides, one percent of all volatile organic compounds, 25 percent of all sulfur oxides, and two percent of all carbon monoxide at the state level.

Central Puget Sound Perspective - Diesel Emissions Contribute Ten Percent of all PM_{2.5}

In Central Puget Sound, diesel emissions contribute ten percent of all fine particulates. This is equal to 66 percent of mobile sources, which are 15 percent of all PM_{2.5}.



Diesel emissions also contribute 46 percent of all nitrogen oxides, three percent of all volatile organic compounds, 42 percent of all sulfur oxides, and two percent of all carbon monoxide at the regional level.

In the Central Puget Sound urban areas, where more people are generally exposed to these pollutants in close proximity, diesel emissions contribute to 15 percent of all fine particulates.